

CLAIMS

What is claimed is:

1. An apparatus for controlling the plasma density in a plasma processing system having a workpiece holder within a chamber, the apparatus comprising:
 - a power circuit arranged to supply RF power to the chamber suitable for striking a plasma within the chamber; and
 - a feedback circuit coupled to said power circuit, said feedback circuit including a RF probe partially disposed in an interior of the chamber, said RF probe measuring a change in plasma density, said feedback circuit adjusting RF power in response to said change in plasma density.
2. The apparatus of claim 1 wherein said power circuit includes a power supply coupled to a matching network, said matching network coupled to a coil adjacent to the chamber.
3. The apparatus of claim 1 wherein said feedback circuit further comprises:
 - a network analyzer coupled to said RF probe;
 - a computer coupled to said network analyzer,

wherein said network analyzer measures a plurality of reflection coefficients of the RF power generated by said RF probe over a spectrum of frequencies,

wherein said computer adjusts the RF power based on a shift in said plurality of reflection coefficients of the RF power over said spectrum of frequencies.

4. The apparatus of claim 1 wherein said RF probe includes an insulated antenna surrounded by a quartz sheath.

5. A plasma processing system comprising:

a chamber;
a workpiece holder in an interior of said chamber;
a first power circuit having a first power supply coupled to a first matching network, said first matching network coupled to a coil adjacent to said chamber;
a second power circuit having a second power supply coupled to a second matching network, said second matching network coupled to said workpiece holder; and
a feedback circuit including:

a Radio Frequency (RF) probe partially disposed in said interior of said chamber; and

a controller coupled to said RF probe and said first power circuit,
wherein said RF probe measures a change in plasma density in said interior of said chamber and said controller adjusts said first power supply in response to said change in plasma density.

6. The plasma processing system of claim 5 wherein said RF probe includes an insulated antenna surrounded by a quartz sheath.

7. The plasma processing system of claim 5 wherein said controller further comprises:

a network analyzer coupled to said RF probe; and
a computer coupled to said network analyzer and to said first power circuit.

8. The plasma processing system of claim 7 wherein said network analyzer includes a third power supply coupled to a high frequency (HF) transmitter and receiver.

9. The plasma processing system of claim 7 wherein said network analyzer generates a HF signal to said RF probe.

10. The plasma processing system of claim 9 wherein said network analyzer measures a plurality of reflection coefficients of said HF signal over a spectrum of frequencies, a change in said plurality of reflection coefficients of said absorbed HF signal representative of a change in plasma density.

11. A method for controlling the plasma density in a chamber of a plasma processing system comprising:

generating an RF signal in an interior of the chamber;
measuring a change in reflection coefficient of said RF signal over a spectrum of frequencies; and

adjusting a power supply configured to strike a plasma within the chamber in response to said change in reflection coefficient of said RF signal.

12. The method of claim 11 further comprising:

partially inserting a RF probe in a sidewall of the chamber; and surrounding said RF probe with a quartz sheath, said RF probe generating said RF signal.

13. An apparatus for controlling the plasma density in a chamber of a plasma processing system comprising:

means for generating an RF signal in an interior of the chamber;
means for measuring a change in a reflection coefficient of said RF signal over a spectrum of frequencies; and
means for adjusting a power supply configured to strike a plasma within the chamber based on said change.

14. An apparatus for controlling the plasma density in a plasma processing system having a workpiece holder within a chamber, the apparatus comprising:

a power circuit arranged to supply RF power to the chamber suitable for striking a plasma within the chamber; and
a feedback circuit coupled to said power circuit, said feedback circuit including a RF probe partially disposed in an interior of the chamber, said RF probe measuring a change in plasma density, said feedback circuit adjusting RF power in response to said change in plasma density to maintain a near constant plasma density in the chamber.

15. A product prepared by a process comprising:
 - processing a wafer in a plasma chamber while maintaining plasma density at a near constant level in an interior of said plasma chamber;
 - wherein said maintaining includes:
 - generating an RF signal in said interior of said plasma chamber;
 - measuring a change in reflection coefficient of said RF signal over a spectrum of frequencies; and
 - adjusting a power supply configured to strike a plasma within said plasma chamber in response to said change in reflection coefficient of said RF signal.